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METHODS OF TEST FOR PULP

PART II DETERMINATION OF FREENESS OF PULP

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard
METHODS OF TEST FOR PULP
PART II DETERMINATION OF FREENESS OF PULP

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Indian Standard
METHODS OF TEST FOR PULP
PART II DETERMINATION OF FREENESS OF PULP

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 20 July 1971, after the draft finalized by the Paper Sectional Committee had been approved by the Chemical Division Council.

0.2 For obtaining good quality of paper, it is essential that the pulp which goes into the manufacture of paper is properly cooked and bleached. Formulation of this standard had been taken up in order to guide the people working in pulp and paper mills regarding the methods to be adopted for pulp analysis.

0.3 The freeness test is a wholly empirical one and it gives a measure of the rate at which a dilute suspension of pulp may be partially dewatered. The result depends upon the degree of fibrillation of the pulp, the degree and manner of subdivision of the fibres and flexibility while wet, which in turn depends on their structural dimensions and composition. The test results are also greatly influenced by the test conditions, such as pressure head, temperature, stock concentration, etc. A temperature of 27°C and stock concentration of 0·3 percent has been prescribed. Since it may not always be possible to obtain these conditions exactly, correction tables are under preparation covering the temperature range of 20°C to 35°C and bamboo pulp concentration of 0·20 percent to 0·40 percent.

0.4 In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part II) prescribes the methods of test for determination of Canadian Standard Freeness and Schopper Reigler Freeness of pulp.

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*Rules for rounding off numerical values (*revised*).

2. QUALITY OF REAGENTS

2.1 Unless otherwise specified, pure chemicals and distilled water (*see* IS : 1070-1960*) freshly boiled and cooled, shall be employed in the tests.

NOTE — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the results of analysis.

3. CANADIAN STANDARD FREENESS

3.0 General — When a dilute suspension of pulp is given a mechanical treatment (beating), it acquires affinity for water and the rate of drainage is altered. This change is related to surface condition and swelling of fibres. The pulp is said to have become less free or more wet. The Canadian standard freeness test is designed to measure this rate of drainage. It is applicable to dilute suspension of pulps of all types.

3.1 Apparatus

3.1.1 The apparatus consists of two main parts — the drainage container *A* and the rate measuring funnel *B*, as shown in Fig. 1 — mounted on a suitable stand so that both are held exactly level.

3.1.2 The drainage container *A* is a metal cylinder of one litre capacity, usually of bronze, closed at the bottom with a perforated screen and a hinged base which falls open when the catch is lifted. The base is fitted in such a way that not more than 5 ml of water will flow when the bottom cover is opened at the start of the test. On the top of the cylinder is clamped a cover. Both the covers are lined with rubber and are water-tight when closed. An air-cock is inserted in the centre of the upper lid. This enables air to enter the cylinder at the start of the test. The cylinder is of 101·5 mm inside diameter and the inside height from the upper surface of the screen plate to the rim is 127 mm. The diameter is critical. The air cock has a bore of 5 mm. The screen plate has a thickness of 0·5 mm. It has perforations of 0·5 mm diameter spaced 97 per sq cm^2. The plate is mounted so that the burr of the punched perforations is downward. Since it is not possible to duplicate these plates by reference to dimensions of holes, so all the plates are standardized usiug reference plates.

3.1.3 The rate measuring conical funnel *B*, usually made of bronze or chrome plated, has an open cylindrical top 203 mm inside diameter and 278 mm length. These dimensions are not critical. The main cone has a 30 degree slope on the inside which flares cut into a top cylindrical portion. The bottom terminates in a carefully machined, removable, orifice which is calibrated to discharge 530 ± 5 ml of distilled water per

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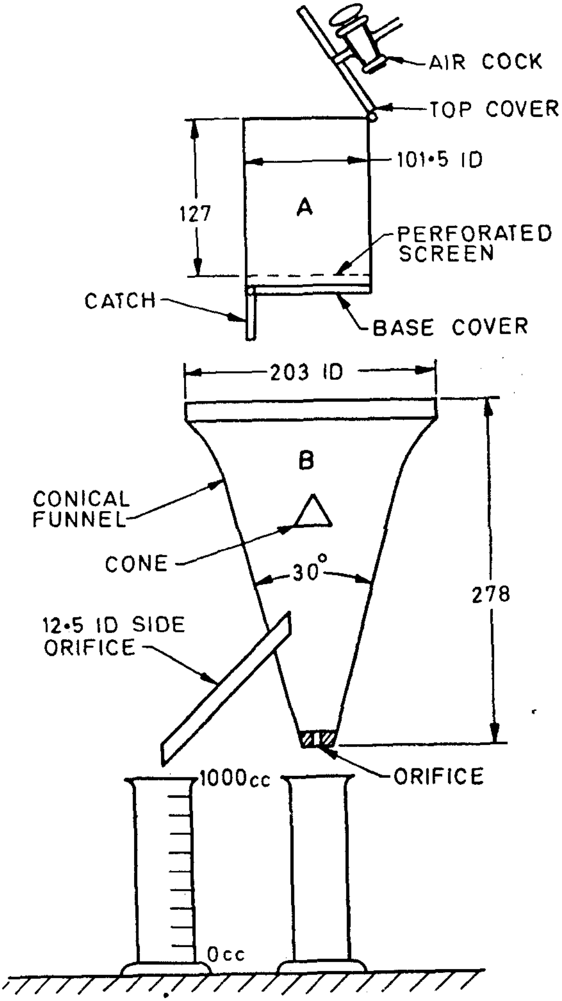
*Specification for water, distilled quality (*revised*).



All dimensions in millimetres.

FIG. 1 APPARATUS FOR DETERMINATION OF CANADIAN STANDARD FREENESS

minute at 27°C when a constant head is maintained by slight overflow through the side orifice. The side orifice consists of a hollow tube 12·5 mm inside diameter which penetrates the wall of the funnel. The tube is inserted so that the volume between the top of the bottom orifice plate and the overflow level is 23·5 ± 0·2 ml. These dimensions are critical and should not be disturbed. A detachable spreader cone is supported on three legs inside the funnel to prevent splash from directly entering the side orifice tube.

3.2 Precautions — Following precautions should be observed while performing the test:

a) Before use, the instrument should be washed well with clean water and if necessary with a detergent and the last traces of detergent removed.

b) Wet the chamber with distilled water before starting any test.

c) The instrument should be clean and free from stock accumulations, pitch oil or grease.

d) After each test the chamber should be rinsed with clean distilled water. No pulp should be left in the holes of the screen plate.

e) When replacing the screen plate, any pressure that will squeeze the chamber out of round should be avoided.

f) The side orifice should not be disturbed or removed.

g) If the instrument is to be left out of use, it should be washed thoroughly so that no pulp dries on it and both top and bottom lids should be left open.

3.3 Standard Test Conditions — The standard test conditions are a slush stock of consistency 0·3 percent and a temperature of 27°C. In case the consistency or temperature are different, then correction for either or both has to be applied for correcting the result to that for standard condition.

3.4 Calibration of Instrument — Calibrate the instrument frequently using 1 000 ml of distilled water at 27°C. The discharge through the side orifice should be 870 ± 2 ml of water if the instrument is correct, otherwise clean the instrument with organic solvent or detergent followed by hot water.

3.5 Procedure — Clean thoroughly and wet the freeness tester with clean water at 27°C. Place the drainage container on the upper supporting bracket with its lower lid secured and the air-cock in the upper lid open. Place the graduated cylinder in position to receive the discharge from the side orifice. Determine the oven dry consistency of the slush sample. In case it is very much different from that required for the standard test condition, namely 0·3 percent, adjust it to be near about the same. Determine the temperature of the stock to the nearest 0·5°C. Measure 1 000 ml of the representative sample of the stock in a clean graduated cylinder. Close the bottom of the chamber. Open the top lid and the air-cock. Immediately pour the contents of the cylinder gently into the chamber. Close the top lid and air-cock. Open the bottom lid and after an interval of 5 seconds from the time of pouring the stock, open tne air-cock to start the flow. When the side discharge has ceased, read the volume of this discharge correctly up to 1 ml, where necessary apply the correction from tables for reducing the results to those of standard conditions.

3.6 Report — Report the average freeness reading corrected to 0·3 percent consistency and 27°C to the nearest millilitre. Duplicate determinations should be within 2 percent of the average

4. SCHOPPER REIGLER FREENESS

4.1 Apparatus — The apparatus consists of a stainless steel cylinder having an internal diameter of 138 mm and minimum height of 115 mm with a conical piece at the bottom. A conical piece acting as a valve is set in the neck of the cylinder and is provided with a water-tight rubber joint. This valve may be operated either mechanically or manully. Below this valve is fitted a 0·20-mm mesh size copper wire gauze having 100 cm² free area. The gauze is kept in plane by a suitable tightening device. The cylinder and the wire are supported on an inverted cone. The bottom of the cone is fitted with a carefully calibrated crifice with a straight tube extension. The lower part of the cone is also provided with a side discharge orifice in the form of bent tube the inside end of which penetrates the cone and reaches its axis. Above the tube is a conical deflector having apertures 600 mm² in total area along its periphery. The external angle of this deflector is 120°C. The volume of the lower part of the cone below the projecting tube and the control aperture shall be between 7·5 and 8 ml. An air outlet tube is also provided. The apparatus is mounted on a stand. The apparatus is shown in Fig. 2.

4.2 Precautions — The following precautions should be observed:

a) The axis of the instrument should be vertical.

b) Wire mesh should be perfectly clean from the deposits.

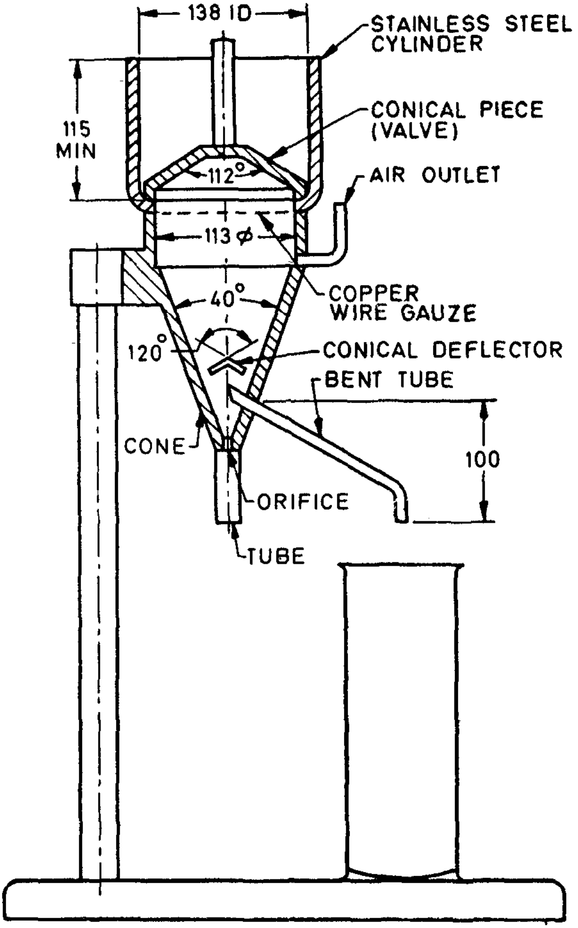
c) Calibrate the instrument before use every time.

d) If the tests are carried out under conditions of temperature and consistency different from those specified, corrections should be applied for the same, by making charts for these.

4.3 Calibration of Instrument — Pour one litre of distilled water at 27°C into the upper cylinder, with valve closed. Open the valve either manually or by automatic control. Measure the time of flow of water through the central orifice alone. This should be between 148 to 150 seconds if the instrument is correct.

Repeat the above experiment with both orifices open, 40 ml of water should flow through the vertically down orifice and 900 ml through the other orifice.

4.4 Procedure — Bring the entire apparatus to 27°C by running water through the system. Take a representative sample, disintegrate the same in a standard disintegrator if not already sufficiently disintegrated. Bring the



All dimensions in millimetres.

FIG. 2 APPARATUS FOR DETERMINATION OF SCHOPPER REIGLER FREENESS OF PULP

consistency of the pulp to 2 g/l. Homogenize the one litre test sample by pouring from one cylinder to the other at least five times. With the valve tightly closed, pour the specimen in the centre of upper cylinder. Place the graduated cylinder with graduations of freeness valve from 0 to 100 top to bottom, below the bent tube and immediately open the valve either manually or with the automatic release. When the water ceases to flow from the orifice, read the freeness value directly from the measuring cylinder under the tube.

BUREAU OF INDIAN STANDARDS

***Headquarters*:**
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones: 323 0131, 323 3375, 323 9402
Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha
(Common to all Offices)

Central Laboratory :	Telephone
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